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ASSESSMENT OF ARTIFICIAL INTELLIGENCE ADOPTION AMONG SCIENCE TEACHERS IN PUBLIC SENIOR SECONDARY SCHOOLS IN GIREI LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA

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ABSTRACT
This study examined the level of artificial intelligence (AI) adoption among science teachers in public senior secondary schools in Girei Local Government Area, Adamawa State, Nigeria. The Diffusion of Innovations Theory guided the study. A descriptive survey design was adopted. The population comprised 472 teachers, from which 210 science teachers were randomly selected to participate. Data were collected using an adapted 20-item Artificial Intelligence Utilisation Questionnaire. Mean and standard deviation were used to determine AI adoption levels. In contrast, independent-samples t-tests examined differences in AI adoption by gender and teaching experience at the 0.05 level of significance. The findings revealed a moderate level of AI adoption among science teachers, with greater use reported for obtaining science teaching examples, explaining difficult concepts, and preparing lesson notes. In comparison, teachers reported lower use of AI-based simulations, preparing science instructional materials in local languages, planning classroom activities, and AI-assisted feedback. AI adoption differed significantly by gender, with female teachers reporting higher adoption than male teachers, $t(208) = -2.08$, $p = 0.039$. However, AI adoption did not differ significantly by teaching experience, $t(208) = -1.23$, $p = 0.219$. The study concludes that AI has begun to feature in science teachers' instructional practices, although its adoption varies across instructional activities and gender. The study recommends opportunities for science teachers to strengthen their effective and responsible use of AI across a wider range of instructional activities.

Keywords: artificial intelligence adoption; science teachers; secondary education; digital support

Introduction

Artificial intelligence (AI) now supports several educational activities, including lesson planning, content generation, formative assessment, feedback, translation, simulation, and the analysis of learning needs. In science education, these functions can help teachers explain abstract concepts, prepare diagrams, produce practice questions, and design learning activities when conventional laboratory and instructional resources remain limited. Holmes and Tuomi (2022) caution that educational claims about AI must distinguish current technical capability from promotional expectation. This distinction matters because AI's educational value depends on teachers' professional judgement, subject knowledge, and ability to verify generated content before classroom use. Miao and Holmes (2023) likewise recommend a human-centred approach that combines educational benefit with regulation, capacity building, privacy protection, and critical evaluation.

Science education requires teachers to connect theoretical ideas with observable processes and practical investigation. Nigerian public schools often face shortages of laboratory equipments, unstable electricity, restricted internet access, large classes, and uneven access to digital devices. AI cannot remove these structural constraints, but selected tools can assist teachers with examples, diagrams, simulations, explanatory analogies, and assessment items. Okunade (2024) and Ugosor et al. (2026) identify these possibilities in Nigerian science education, but both accounts also stress infrastructure, professional preparation, and responsible use. Teachers must therefore understand the limits of generated information, check scientific accuracy, and protect students from misleading explanations.

Teacher adoption involves more than awareness of a tool. A teacher may know about ChatGPT, AI-enabled search tools, translation applications, automated quiz generators, or virtual laboratories without using them for instruction. Adoption refers to observable use in tasks such as preparing lesson notes, explaining difficult concepts, designing questions, locating illustrations, supporting revision, or providing feedback. Ng et al. (2021) describe AI literacy as a combination of knowledge, practical use, critical evaluation, and ethical understanding. Thus, teachers need both functional skills and the capacity to judge the accuracy, fairness, privacy implications, and educational suitability of AI output.

Research on African science teachers shows growing interest in AI, but adoption remains uneven. Nja et al. (2023) found that perceived usefulness and ease of use contributed to teachers' behavioural intention to use AI, while some demographic variables did not produce significant differences. Ayanwale et al. (2025) modelled readiness as a progression from unawareness to adoption and possible discontinuance, showing that teachers may stop using AI when resources and support remain weak. International evidence reaches a similar conclusion. Hazzan-Bishara et al. (2025) found that institutional support, self-efficacy, perceived usefulness, and perceived ease of use contributed to teachers' intention to adopt generative AI. Nazaretsky et al. (2022) also showed that professional development can strengthen teachers' informed trust in AI-supported educational technology.

Most Nigerian researchers have concentrated on general opportunities, university education, teacher education, or conceptual discussion. Okunade (2024), Ebhomien and Omokhomion (2025), Muhammad et al. (2025), Usman (2025), and Ugosor et al. (2026) provide useful accounts of possible applications and constraints. Still, they do not establish the detailed pattern of actual AI use among public senior secondary school science teachers in Girei. The present study therefore examines the instructional tasks for which teachers use AI, the level of school support and training, and differences by gender and teaching experience.

Statement of the Problem

Public discussion about AI in education often assumes that access to widely available applications has produced regular classroom use. This assumption remains uncertain in public senior secondary schools in Girei Local Government Area. Teachers may

use personal smartphones to search for information or prepare lessons, but this individual activity does not necessarily amount to sustained, educationally sound adoption. Schools may also lack digital platforms, reliable internet access, professional training, technical guidance, and clear rules for responsible use. Without empirical evidence, educational planners cannot determine whether teachers use AI mainly for simple preparatory tasks or for more demanding activities such as simulations, differentiated support, feedback, and assessment.

Several studies examine readiness, intention, or general perceptions rather than item-level instructional use. Most studies also treat infrastructure and training as broad recommendations without measuring the support teachers report in their schools. Findings on gender and teaching experience remain inconsistent across contexts. Nja et al. (2023) reported no significant demographic influence on behavioural intention, while other local accounts suggest that adoption may differ among teacher groups. The absence of evidence from Girei therefore goes beyond geographical coverage. It concerns the form of adoption measured, the distinction between personal use and institutional support, and the limited comparison of teacher groups. This study addresses these gaps through a task-based measure of AI use and demographic comparisons.

Theoretical Framework

The study adopted the Diffusion of Innovations Theory, developed by Everett M. Rogers in 1962, which states that new ideas, technologies, practices, or innovations are adopted and spread among members of a social system. Rogers identified five characteristics that influence innovation adoption: relative advantage, compatibility, complexity, trialability, and observability. The theory also explains that individuals differ in the rate at which they adopt innovations, ranging from innovators and early adopters to the early majority, late majority, and laggards.

The theory is relevant to the present study because artificial intelligence (AI) is an emerging technological innovation in education, and science teachers are potential adopters. Teachers may adopt AI when they perceive it as useful, compatible with their instructional practices, manageable to use, and capable of producing observable benefits. The varying levels of AI use across instructional activities in this study can therefore be understood through how teachers perceive and experience AI as an educational innovation. The theory also provides a useful basis for examining differences in AI adoption among teachers based on demographic characteristics such as gender and teaching experience. However, because the study did not directly measure Rogers' five innovation attributes or classify teachers into adopter categories, the theory serves primarily as a framework for interpreting the findings rather than a theory the study directly tested.

Purpose of the Study

The study assessed artificial intelligence adoption among science teachers in public senior secondary schools in Girei Local Government Area, Adamawa State, Nigeria. The specific objectives were to determine:

1. The extent to which science teachers use artificial intelligence for instructional purposes;
2. Whether artificial intelligence adoption differs by gender;
3. Whether artificial intelligence adoption differs by teaching experience.

Research Questions

1. To what extent do science teachers use artificial intelligence for instructional tasks?
2. Does artificial intelligence adoption differ by gender?
3. Does artificial intelligence adoption differ by teaching experience?

Research Hypotheses

1. There is no significant difference in artificial intelligence adoption between male and female science teachers.

2. There is no significant difference in artificial intelligence adoption among science teachers with less than five years of teaching experience and those with five years or more of teaching experience.

Methodology

The study adopted a cross-sectional descriptive survey design. This design allowed the researchers to collect self-reported information on teachers' instructional use of AI, gender, and teaching experience at one point in time. The design was suitable for estimating the reported extent of adoption and comparing predefined groups. The population comprised 472 teachers in public senior secondary schools in Girei Local Government Area during the 2025/2026 academic session (Adamawa State Post Primary Schools Management Board). The study identified science teachers from the population, and 210 science teachers were randomly selected to participate. The selected participants comprised 110 males and 100 females. The teaching-experience groups comprised 65 teachers with fewer than five years of service and 145 teachers with five years or more of service. The researchers adapted the Artificial Intelligence Utilisation Questionnaire to collect data. The instrument contained demographic questions and twenty items on a five-point scale. The twenty items measured instructional AI use, including searching for teaching materials, explaining difficult concepts, preparing lesson notes, generating assessment questions, locating diagrams, planning activities, providing feedback, and using simulations. Responses ranged from 1 (Never), indicating the lowest level of use or support, to 5 (Always), indicating the highest level. Three experts in science education assessed the instrument for face and content validity, focusing on relevance, clarity, coverage, and alignment with the study objectives. The researchers piloted the instrument with 25 teachers outside the study sampling frame. The full scale produced a Cronbach's alpha coefficient of 0.88, indicating satisfactory internal consistency. The researchers obtained permission to conduct the study from the principals of the participating public senior secondary schools. The researchers explained the study's purpose and procedures to the participating science teachers before administering the questionnaire. The researchers obtained informed consent from the teachers, and participation was voluntary. The questionnaire did not request participants' names or other direct identification, thereby maintaining anonymity. Participants were informed that their information would be treated confidentially and used solely for the purposes of the study. The mean and standard deviation were used to answer the research questions. The decision rule classified mean scores from 1.00 to 2.33 as low, 2.34 to 3.67 as moderate, and 3.68 to 5.00 as high. The independent-samples t-test tested the hypotheses about differences in AI adoption by gender and teaching-experience groups at the 0.05 level of significance. The decision rule is to reject the null hypothesis when the p-value is less than 0.05 and to retain it when the p-value is equal to or greater than 0.05.

Results

Research Question One: To what extent do science teachers use artificial intelligence for instructional tasks?

Table 1: Instructional Use of Artificial Intelligence

No.	Item	Mean	SD	Level
1	I use AI-enabled search tools to obtain science teaching examples.	3.84	0.94	High
2	I use AI tools to explain difficult science concepts before lessons.	3.76	1.08	High
3	I use AI tools to prepare lesson notes.	3.69	0.97	High
4	I use AI-supported applications to generate assessment questions.	3.61	1.12	Moderate
5	I use AI translation tools to simplify scientific terms for students.	3.55	1.03	Moderate
6	I use AI tools to generate my lesson materials.	3.51	0.89	Moderate
7	I use AI tools to improve my lesson materials.	3.47	1.15	Moderate
8	I use AI applications to provide additional explanations to students outside the classroom.	3.42	1.06	Moderate
9	I use AI tools to prepare revision questions for students.	3.38	0.98	Moderate
10	I use AI tools to identify simpler ways of presenting abstract science topics.	3.34	1.10	Moderate
11	I use AI-powered mobile applications to support science teaching.	3.28	1.21	Moderate
12	I use AI tools to analyse students' learning difficulties.	3.27	0.98	Moderate
13	I use AI tools to personalise science learning activities according to students' individual learning needs.	3.25	1.01	Moderate
14	I use AI tools to support students with different learning abilities.	3.21	1.04	Moderate
15	I use online AI platforms to obtain practical science activities that require fewer laboratory materials.	3.16	1.18	Moderate
16	I use AI tools to assist in marking students' assessments.	3.09	1.26	Moderate
17	I use AI applications to give feedback on students' assignments.	3.03	1.14	Moderate
18	I use AI tools to plan classroom activities that encourage student participation.	2.96	1.09	Moderate
19	I use AI tools to prepare science instructional materials in local languages.	2.88	1.22	Moderate
20	I use AI-based simulations to demonstrate science experiments.	2.81	1.31	Moderate

[Decision rule: 1.00–2.33 = low; 2.34–3.67 = moderate; 3.68–5.00 = high. Instructional-use mean = 3.33]

The instructional-use mean of 3.33 indicates moderate adoption. Teachers reported high use of AI-enabled search tools (M = 3.84, SD = 0.94), AI tools for explaining difficult concepts (M = 3.76, SD = 1.08), and AI tools for preparing lesson notes (M = 3.69, SD = 0.97). The remaining practices fell in the moderate range. The lower-rated practices concerned AI-based simulations (M = 2.81, SD = 1.31), local-language instructional

materials (M = 2.88, SD = 1.22), participatory classroom planning (M = 2.96, SD = 1.09), and AI-assisted feedback (M = 3.03, SD = 1.14). These results show that teachers used AI more often for accessible preparation and explanation than for technically demanding or school-dependent instructional activities.

Hypothesis One: There is no significant difference in artificial intelligence adoption between male and female science teachers.

Table 2: AI Adoption by Gender

Gender	N	Mean	SD	t	Df	P	Decision
Male	110	3.17	0.56	-2.08	208	0.039	Rejected
Female	100	3.34	0.59				

The result indicates a statistically significant difference in AI adoption between male and female science teachers, t(208) = -2.08, p = .039. Since the p-value (0.039) is less than the 0.05 significance level, H_{01} is rejected. Female science teachers had a higher mean AI adoption score (M = 3.34, SD = 0.59) than male science teachers (M = 3.17, SD = 0.56).

Hypothesis Two: There is no significant difference in artificial intelligence adoption among science teachers with less than five years of teaching experience and those with five years or more of teaching experience.

Table 3: AI Adoption by Teaching Experience

Teaching experience	N	Mean	SD	T	df	p	Decision
Below 5 years	65	3.18	0.54	-1.23	208	0.219	Retain
5 years and above	145	3.28	0.59				

The result indicates that there was no statistically significant difference in AI adoption by teaching experience, t(208) = -1.23, p = 0.219. Since the p-value (0.219) is greater than the 0.05 significance level, the hypothesis is retained. Teachers with 5 years or more of experience recorded a slightly higher mean AI adoption score (M = 3.28, SD = 0.59) than those with less than 5 years of experience (M = 3.18, SD = 0.54), but the difference was not statistically significant.

Discussion of Findings

The study found a moderate level of artificial intelligence (AI) adoption among science teachers in public senior secondary schools in Girei Local Government Area, with an overall instructional-use mean of 3.33. Teachers reported the highest use of AI to obtain science teaching examples, explain difficult science concepts, and prepare lesson notes. In contrast, teachers reported the lowest use of AI for AI-based simulations, preparing instructional materials in local languages, planning classroom activities, and providing AI-assisted feedback. This finding aligns with Nja et al. (2023), who found that perceived usefulness and ease of use were associated with AI adoption among African science teachers. The finding also agrees with Ayanwale et al. (2025), who reported that teachers' readiness for AI adoption varies across stages of adoption and may be influenced by the availability of resources and support. Similarly, Hazzan-Bishara et al. (2025) found that perceived usefulness, self-efficacy, ease of use, and institutional support were important determinants of teachers' intention to adopt AI technologies. These studies provide support for the present finding that teachers may be more likely to use AI for relatively accessible tasks such as obtaining examples, explaining concepts, and preparing lesson materials than for activities requiring greater technical capacity or instructional integration.

However, this finding differs from studies and discussions that portray AI as broadly integrated across multiple dimensions of teaching and learning. For example, Holmes and Tuomi (2022) described AI as having potential applications in lesson planning, assessment, feedback, translation, simulation, and learning support. Similarly, Miao and Holmes (2023) identified a wide range of possible educational applications of generative AI. This difference

may reflect the gap between AI's potential uses and teachers' reported use. Although AI tools may support several instructional activities, teachers in Girei may face limitations related to digital infrastructure, internet access, professional preparation, confidence, and access to appropriate AI applications. Therefore, the moderate level of adoption found in the present study suggests that the availability of AI tools does not necessarily result in uniform adoption across instructional activities.

The study also found a statistically significant gender difference in AI adoption, with female science teachers reporting higher adoption than their male counterparts. Female teachers recorded a mean adoption score of 3.34, compared with 3.17 for male teachers, and the difference was statistically significant, $t(208) = -2.08$, $p = .039$. This finding does not align with Nja et al. (2023), who reported that demographic variables did not significantly influence science teachers' behavioural intention to adopt AI. The difference between the two findings may reflect differences in geographical context, sample characteristics, measurement approaches, or the distinction between behavioural intention and reported instructional use. While Nja et al. (2023) examined teachers' intention to adopt AI, the present study focused on reported AI use for specific instructional tasks. This difference may reflect a gap between what teachers intend to do and what they report doing.

The study further found no statistically significant difference in AI adoption based on teaching experience. Teachers with five years and above of teaching experience recorded a slightly higher mean adoption score ($M = 3.28$, $SD = 0.59$) than teachers with less than five years of experience ($M = 3.18$, $SD = 0.54$). Still, the difference was not statistically significant, $t(208) = -1.23$, $p = .219$. This finding aligns with Nja et al. (2023), who also found that demographic characteristics did not significantly influence teachers' behavioural intention to adopt AI. The agreement suggests that the number of years a teacher has spent in the profession may not, by itself, determine the extent to which the teacher adopts AI for instructional purposes. This finding also aligns with Ayanwale et al. (2025), who argue that AI adoption is better understood as a process shaped by several factors rather than a single demographic characteristic. However, this result does not rule out the possibility that teaching experience may matter under different conditions. Teachers with more years of experience recorded a slightly higher mean adoption score, but the difference was not statistically significant. This may indicate that factors such as access to technology, digital competence, professional development, perceived usefulness, self-efficacy, and opportunities to use AI may be more influential than years of teaching experience. Nazaretsky et al. (2022), for example, demonstrated the importance of professional development in strengthening teachers' informed trust in AI-supported educational technology. Thus, differences in access to professional learning opportunities may matter more for AI adoption than teaching experience alone.

Overall, the findings indicate that AI adoption among science teachers in Girei is developing but remains uneven across instructional activities. Adoption is stronger for relatively accessible activities such as obtaining examples, explaining concepts, and preparing lesson notes, while more specialised applications such as simulations, feedback, and local-language instructional materials are used less often. The alignment of the present findings with several psrevious studies supports the view that perceived usefulness, ease of use, self-efficacy, institutional support, and professional development are important considerations in AI adoption. At the same time, the disagreement observed regarding gender suggests that AI adoption may vary across contexts and measurement approaches.

Conclusion

The study concludes that science teachers in public senior secondary schools in Girei Local Government Area demonstrated a moderate level of instructional AI adoption. AI adoption differed significantly by gender, with female teachers reporting higher adoption than

male teachers. However, AI adoption did not differ significantly between teachers with less than five years of teaching and those with five years and above. These findings suggest that AI has begun to feature in science teachers' instructional practices, although its use varies across instructional activities. The study therefore concludes that AI adoption has begun among science teachers in Girei, but sustained, educationally sound integration requires structured professional learning, school guidance, and careful evaluation of AI-generated content.

Recommendations

1. Relevant education authorities and school administrators should encourage the effective and responsible integration of AI into science teaching. These efforts should focus on helping teachers understand how to apply AI appropriately across different instructional activities while maintaining sound professional and pedagogical practices.
2. Teacher education and professional development programmes should incorporate practical AI-related competencies for science teachers. This would help teachers develop the knowledge and skills required to evaluate and use AI tools appropriately for instructional purposes.
3. Further studies should investigate the factors underlying the observed gender difference in AI adoption. Since the present study found significantly higher reported adoption among female teachers but did not examine the reasons for this difference, future research should investigate possible explanatory factors rather than attributing the difference to gender alone.
4. Future researchers should examine AI adoption using broader samples and other research designs, including studies involving different subject areas, locations, and school types, as well as studies that combine self-reported data with classroom observations or other measures of actual AI use.

Limitations of the Study

The study relied on self-reported data, which may not fully reflect teachers' actual classroom AI use. It covered one local government area and therefore does not represent all science teachers in Adamawa State or Nigeria. The cross-sectional design captured teachers' reported AI adoption at one point in time and therefore does not establish causal relationships or changes in AI use over time. The study was limited to science teachers in public senior secondary schools in Girei Local Government Area, which may limit the generalisation of the findings to other settings.

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